AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation

May 1980

OUR MAY 5 MEETING will be a talk by Joel Nelson, K4JUM on how to interface with the telephone company. The meeting will be held at 7:30 p.m. in the Patrick Henry Branch Library, 101 Maple Ave. E, Vienna, VA. Guests and visitors are welcome.

AMRAD 1980 SCIENCE FAIR AWARDS were made at two Northern Virginia high schools on March 21 and 22. Results were as follows:

Awards:

Dennis M Blakey Alexandria, VA	"Computer Telephone"
Clyde Fortna Arlington, VA	"TRS-80 as Lab Instrumentation"
Andre des Rosiers Arlington, VA	"Laser Audio Transceiver"
Steven B Waltman Annandale, VA	"Computer Simulation of Analog System"

Honorable Mention:

Michael Bratti	Arlington, VA
Victor N Davis	Alexandria, VA
Kenneth D Lender	Alexandria, VA
Colleen Mathias	Arlington, VA
Leslie A Shriner	Falls Church, VA
Robert M Swierczek	Alexandria, VA

As in previous years, this program was managed by Bill Pala, WB4NFB. Bill wishes to thank Eric Nyman, WA4HIS and Terry Fox, WB4JFI for serving as judges this year.

Plans are for the four award winners to give a show & tell on their projects at the June 2 AMRAD meeting.

MAY 15 IS THE DEADLINE for mailing evidence of two-way on-the-air ASCII contact via the AMRAD WD4IWG/R repeater during the period March 17 through April 16. A photocopy of a QSL card or of the entry in your station log is considered evidence for this purpose. Stations listed in the April 1980 issue of the *AMRAD Newsletter* need not apply because certificates will be automatically issued to these stations.

AN AD MANAGER IS NEEDED for the *AMRAD Newsletter*. If you can handle it, please call Paul Rinaldo, W4RI, 703-356-8918.

HONORARIUMS FOR TECHNICAL ARTICLES published in the *AMRAD Newsletter* will be paid to authors starting in the June 1980 issue. This action was approved by the AMRAD Board of Directors in order to stimulate a continual flow of high-quality technical articles. For the author, it provides some incentive to document ideas and projects so that the other members can benefit from the author's work.

Honorariums will be limited to $10 per published page and a maximum of $20 per author per month. Partial payment will be made for partial pages. The $20 limitation is there for two reasons: (1) to provide a disincentive for just rambling on; and, (2) to keep costs within bounds that can be supported over the long term. *We believe that this will not dip into the treasury in the long run because the increase in membership generated by improving the newsletter.*

To qualify, articles must be original work of the author. Material published elsewhere will not qualify for an honorarium. However, this will not restrict other newsletters from reprinting *AMRAD Newsletter* articles so long as credit is given to both the author and to the *AMRAD Newsletter*.

Acceptance of articles will be the decision of the editor. As in the past, the editor reserves the right to reject or edit any portions of the copy. Because the payment is based on the published page, or portion thereof, the dollar amount will be determined when the copy goes to the printer. The editor will notify the treasurer of the amounts to be paid.

Manuscripts should be double spaced typewritten copy, upper and lower case. Computer program listings should be prepared using a new ribbon (preferably carbon film), on white paper (nothing on the back), 40 characters to the line. Tables and figures must be camera ready. In most cases, figures will be reduced to 70 - 80% of their original size. Authors with word processors wishing to submit camera-ready copy should first check with the editor.

This invitation to submit articles and receive honorariums is open to all, whether AMRAD member or not. We are looking for articles on a wide range of subjects, such as: amateur radio and personal computing, electronic technology related to the amateur, communications for the handicapped, including new work and tutorials on subjects of interest to the AMRAD membership.

THE FIRST 2-WAY 1200-BAUD ASCII CONTACT over the AMRAD WD4IWG/R repeater was made between Terry Fox, WB4JFI and Joel Nelson, K4JUM at 2030 EST on 28 March 1980. Modems used on both ends were Bell 202 compatible.

1200-BAUD STANDARDS seem to be leaning in the direction of Bell 202, according to informal talk on and off the AMRAD repeater. One reason is that 202 is a half-duplex system, i.e., uses the same pair of tones for both transmit and receive, which is suited to radio transmission. Another is that 202's of one sort or another seem to be available at reasonable prices through a number of sources. One example is that a few ancient Western Electric 202's showed up at the hamfest in Timonium, MD. Another is that a number of our members have the 202-compatible modems surplused in the past few years from International Reservations. Also, word has it that Surplus Electronics of College Park, MD may be getting a large quantity of 202-compatible modems. We will be happy to publish any other sources if you will mail them in.

DIABLO SYSTEMS has announced a new Model 630 daisywheel printer to be sold for about $860 each to Original Equipment Manufacturers (OEM's) in quantities of 500. That's the basic printer mechanism to which you must add a communications interface, control panel, power supply, platten, covers, etc., all of which doubles the price -- still talking 500 quantities. In any event, be on the alert over the next year for variations of the 630 to show up on the market at a price about $500 less than Diablo and comparable printers go for now.

THE MANASSAS HAMFEST will be on June 1 at the Prince William County Fairgrounds, Manassas, Virginia. The 'fest is presented by the Ole Virginia Hams A.R.C., PO Box 1255, Manassas, VA 22110.

AMATEURS WOULD NEED GIVE only their own calls when signing clear with another station, under a Notice of Proposed Rule Making released by the Commission Wednesday (Apr 9). Personal Radio Docket 80-136 would amend Part 97.84(a) of the rules to drop the present requirement, frequently ignored in contests and often overlooked at other times, that an Amateur sign clear with another station when ending a contact. With the proposed amendment, an Amateur station would need give only its own callsign at the beginning or end of each transmission or series of transmissions (and at 10 minute intervals, of course), with no need to send any other station's call at any time during a contact.

International Third Party traffic would provide the only exception to the proposed rules relaxation. International regulations require both stations to send both callsigns when they are handling international third-party traffic.

Comments on PR Docket 80-136 are due at the Commission by July 16, and Reply Comments by August 15. Thanks *HR Report*.

CORRESPONDENCE:

April 8, 1980

Dear Sirs:

The Argonne Amateur Radio Club, at Argonne National Laboratory (a Department of Energy R&D Laboratory), would like to exchange newsletters with AMRAD.

A friend passed along his copy of the *AMRAD Newsletter* from March to us and at once we realized we have some common interests between our club members. Therefore, enclosed are a few recent issues of our newsletter.

Your February issue with the article on Protocol (referred to in the March issue) interests us. Please send the February issue if possible. We are also looking for standards in ASCII packet ham communications.

Our address is:

Argonne Amateur Radio Club
PO Box 275
9700 South Cass Avenue
Argonne, Illinois 60439

Although many of our members are active with RTTY and computers, we do not generally publish technical articles in our newsletter. Once our members do see the interests of AMRAD, however, they may submit information directly to your newsletter.

We look forward to your future issues of the *AMRAD Newsletter*.

Sincerely,
Richard W. Doering, WA6CFM
Club Secretary

Ed. Note: We will begin exchanging newsletters starting with this issue. Copies of Argonne's newsletter have been turned over to our Secretary, Bill Pala, WB4NFB.

MICROCOMPUTER WORD PROCESSING SYSTEMS may become a weapon in America's fight for energy independence. Events in the Middle East make it obvious that we cannot depend on that source of crude oil and one of the first effects of a gasoline shortage will be difficulty for people who use cars to get to work. In a severe gasoline shortage there will be a greatly increased need for people to be able to work at home and communicate with their office over the telephone. Microcomputer-based word processing systems will be able to fill this need at the least expense. I think that it would be a good idea for computer enthusiasts to design and test several such systems including communications and automatic receiving equipment prior to an emergency. I would like to hear from anyone having an interest in this subject. Douglas Du Brul, c/o San Diego Computer Society, PO Box 81537, San Diego, CA 92138; 714-583-3733. Thanks *Personal Systems*.

FRANK DERFLER, K9KIC who writes the Dial-up Directory for *Kilobaud-Microcomputing* will be moving to Herndon, Virginia in June. Frank is a new AMRAD member.

RACAL-VADIC VA103 is both a 103/113-type modem and a telephone for $250 in onesies. Add $80 for auto originate/answer option. Write Racal-Vadic, 4720 L Boston Way, Lanham, MD 20801.

Protocol

David W. Borden, K8MMO
Rt 2, Box 233B
Sterling, VA 22170
703-430-7642 Voice
703-450-5284 Data

ADDITIONAL PACKET PROTOCOL NOTES

Last month I promised to talk about error detection, but a good thing has occurred. People are writing letters to me about protocol. This is highly desired activity; keep it up. First it makes writing this column simple -- just publish your letter. Second, we get the benefit of professionals sharing their ideas from the business world. This month, Bob Carpenter, W3OTC has written a super letter about packet protocols. He does this kind of thing for a living and thus has lots to share with us. If any of you have frequented the AMSAT repeater (WR3ABU, Silver Spring, MD, 146.25 in/146.85 out) you know Bob who promises to show up on the AMRAD repeater (WD4IWG/R, McLean, VA, 147.81 in/147.21 out) now and then. Thanks, Bob. And, without further unrequired introduction, here are Bob's excellent ideas:

Dear Dave,

You've done it! Your piece in the April *AMRAD Newsletter* has overcome my inertia, and you are about to be inundated by some of my ideas on amateur packet radio. As background, I have been involved in local area packet networking, the coaxial cable variety, for the last four years. My net at NBS now has about 60 - 70 users. While I'll be the first to admit that wired and radio systems have their differences, much is common.

I hope you will agree with some of my *basic requirements* for amateur application of packet radio:

1) The protocol should work with *and without* transmission through repeaters.

2) It would be nice to be able to use the same protocol on HF and VHF.

3) The packet design and protocol should be near enough to the commercial main stream that hams can take advantage of the advanced chips coming from the IC houses.

I conclude from your article that we come from different directions. I think that you would find the reading of certain protocol articles to be interesting. A short list would include:

1) L. Kleinrock and F.A. Tobagi, "Packet switching in radio channels: Part 1 - Carrier sense multiple access modes and their throughput-delay characteristics," IEEE Trans. Commun., vol. COMM-23, pp.1400-1416, Dec 1975 (and other papers in the same issue).

2) F.A. Tobagi and V.B. Hunt, "Performance analysis of carrier sense multiple access with collision detection," Proceedings of the LACN Symposium (Mitre-NBS), pp. 217-245, May 1979.

3) Norman Abramson, "The ALOHA System," pp. 501-517 in the book, "Computer-Communications Networks," N. Abramson and F. Kuo, eds., Prentice-Hall, Inc.

4) R.M. Metcalfe and D.R. Boggs, "Ethernet: Distributed packet switching for local computer networks," CACM, 19:7, pp. 395-404; also in Abrams, ed., "Computer Networks: a Tutorial (Revised 1978)," IEEE, 1978.

5) S.S. Lam, "Satellite Packet Communication - Multiple Access Protocols and Performance," pp. 1456-1466, IEEE Trans. Commun., vol. COM-27, no. 10, Oct 1979.

6) Richard Sherman, et al., "Concepts, strategies for local data network architectures," *Data Communications (magazine)*, Jul 1978.

There are lots of other papers that you probably have seen already.

Channel Access Protocols

I hope that you will let me divide multiple-access protocols into the following categories:

1) Transmit "blind": ALOHA, Slotted ALOHA.

2) Carrier sense, multiple access (CSMA) (listen before talk).

3) CSMA-Collision Detect (CSMA-CD): (listen before talk - listen while talk): Ethernet, Mitrenet, NBSNET, many others.

I guess what really got me going is that you seemed to imply that ALOHA represents some reasonable goal to aim for. I can't buy that. Kleinrock, et al., show that an ALOHA channel goes unstable when the offered traffic is only 18% of the raw bit rate (bandwidth) of the channel. Put another way, a 1200-baud channel could only handle 216 bauds without *real* trouble. That's pretty sad performance. You rightly mentioned that Slotted ALOHA is better (since collisions only kill one packet, not two), but the saturation point is still at only 36% of the raw bit rate; 430 bauds for a 1200-baud channel. Remember that ALOHA was designed in the late 60's, *BEFORE MICROPROCESSORS*. I have heard Abramson say that he chose to waste channel bandwidth in order to allow simpler user equipment. The FCC has required that we hams use very low bit rates (ALOHA uses 9600 bauds up), so we can't afford to waste the channel bandwidth.

You also mention X.25 as another sort of goal. It is intended as a (very complex) protocol for user connection to Public Data Network nodes, and I doubt if it will *ever* be used *inside* a network. Of course the level 2 (ADCCP) may fit some networks, but not the multiple-access network case. More on this later. Isn't the U.S. Government standard ADCCP, not HDLC or SDLC, though the differences are slight in most applications?

After looking at the performance of the various channel contention protocols, one might think that a CSMA-CD protocol would be just fine for ham applications. (By collision detection, I mean a protocol in which each station listens to the channel *while* it is transmitting, and truncates its output if it hears a collision; not just the situation where the existence of a collision is infered from lack of an acknowlegement.) Unfortunately, collision detection cannot be used in radio situations, since you usually can't hear the interfering stations through your own local transmitter. You could listen to the output of a repeater to hear if you were being interfered with - but one of my groundrules is that the protocol can't *require* the use of a repeater. See also the situation of "hidden stations" in Kleinrock and Tobagi. The satellite protocols described by Lam are also interesting, but they require a repeater, and each station must know the time delay (its distance) from the repeater in order to transmit in its correct slot.

That leaves us with the simple Carrier Sense-Multiple Access (CSMA) protocols - of which there are a number. They never require that the station listen while it is transmitting, but all require that it not start to transmit while the channel is occupied. The three common variants of CSMA differ in what happens when a station decides it needs to transmit, but finds the channel to be occupied.

You worry about carrier detection, and long squelch tails. The problem seems inherent in any shared-channel system; one must have a quick way of determining that the channel has gone free. I suggest that reducing the length of squelch tails is not beyond the technical capability of radio amateurs. In most cases changing a time constant would do most of the job.

The papers by Kleinrock and Tobagi show a marked difference in performance between the three types of CSMA.

In 1-persistent CSMA, any station that wants to transmit does so as soon as the channel goes free. This results in a collision if two or more stations have recognized need to transmit during the time the channel was occupied by the last packet.

The other extreme is that if a station decides it needs to transmit, but finds the channel busy, it enters a waiting period (defers) before it tries again. This greatly reduces the number of collisions, but results in long delays.

In the third variant, all stations finding need to transmit while the channel is busy wait until the channel goes free. Each station slices the time after the channel "goes free" into short time slots - each slot slightly longer than the round-trip propagation delay between the most distant stations on the channel. Each station makes a *random choice* of which of these time slots in which to start to transmit. Of course it will have to defer again if someone else chose an earlier slot and has already started. If the number of time slots among which a station may randomly choose is 10, there is a probability, $p = 0.1$, that it will choose any specific slot. This type of CSMA (called p-persistent) has both excellent throughput (up to 80 to 90% of the raw bit rate with longish packets), and short delay.

Don't worry about the complexity of the random choice, I think that five or six SSI-MSI chips would do the job; or software would with millisecond slots (150 km radius of communication).

I clearly feel that p-persistent CSMA is the optimum choice for ham packet radio channel contention. Please note that, should a repeater be used, any or all stations can get added improvement in

throughput by listening for collisions while transmitting. Other CSMA schemes, such as Network Systems Corp., Hyperchannel (R), which nearly prevents collisions, would require too much cooperation between the stations on a channel.

Packet Design

Now, on to packet design. Here I think we differ mostly in terminology. I contend that, by the time you have defined a second address field, etc., you no longer have ADCCP (HDLC, SDLC). What *does* seem important is that we should keep in mind that the semiconductor houses make very nice chips that do some of the hard work of ADCCP. For example the Signetics 2652 and the Zilog Z80-SIO both do FLAG generation and detection, frame synchronization, one byte of destination address recognition, Cyclic Redundancy Character (CRC) generation and checking, bit stuffing and unstuffing, and final flag detection. What more could one wish? The Western Digital SD-1933 does all of the above as well as bit synchronization (with a digital PLL) up to 56 kilobauds. Whew! These chips are priced in the $30 range. Western Digital has announced another chip that even does the DMA, sequence number generation and checking, and retransmission of lost frames (packets). This number is *very* expensive as of yet. We should not lose sight of that fact that Local Area Networks are hot stuff in industry, and the semiconductor houses just need a standard (or *de facto* standard) before they spew out chips that will do a lot of the network job for a little money. At the moment an IEEE standards committee, chaired by Maris Graube of Tektronix, is working on a local network standard. We hams should await the result with baited breath.

What should we do until the standard (and the cheap chips) come? I generally support your proposal. We want a layered protocol (no I won't say more about that), so the packet design need only have enough to transport the data between stations in an error-free manner. The packet would seem to have to have the following features:

1) A bit synchronizing pramble,

2) A means of getting fram synchronization (the flag),

3) The identification of the intended recipient,

4) The identification of the sender,

5) Control information such as:

a) Packet type
b) Sequence numbering
c) Acknowledgement of correct reception
d) Control of information flow to avoid overflowing buffers
e) Means for establishing and breaking contacts

6) Any data (information) to be transmitted,

7) Error detection (CRC)

8) A means to tell how long the packet is (a byte count or a closing flag or both),

9) Possibly a few fill characters at the end.

The ADCCP standard provides all these features except the preamble, sender identification, and end-fill. The ADCCP "flag" character is the worst possible choice of a character on which to obtain bit sync. When sent in NRZI (the method implicit in ADCCP, but not required), the "flag" has only two transitions in the whole character - a poor signal to use for bit sync. I propose that a preamble of 16 NRZI zeros be placed at the front of each packet. This will give 16 transitions before the opening flag. The address fields are relatively non-controversial (until you get the FCC into the act). I would like to see some form of shorthand addressing, but haven't come up with anything better than to suggest use of compressed-ASCII. We want the first byte of the destination address to be as unique as possible, because this byte is all that current ADCCP chips check in their hardware address recognition - all the rest of the address recognition must be done by the attached microprocessor (which could be a substantial load). The ADCCP control field looks good about as it stands - interpreted as a distributed-control protocol so that the poll-final bit is a bit out of place (no pun intended). The RR (receive buffer ready) and RNR (receive buffer not ready for more data) responses are the flow control means.

The ADCCP chips do a good CRC and detect the closing flag to end the packet. These features would not be available to stations using regular asynchronous (ten-bit) transmission (before they get their ADCCP chips going). Where bit stuffing (and final flag detection) are not used, a byte count must be inserted as the first character in the DATA field to allow data transparency. I think that a 16-bit CRC could be used even without the ADCCP chips. It only takes a few milliseconds to compute a CRC over a 128-byte packet. I have a program for the 6800.

However, the end of the information part of the packet is determined, I think we may

need to append one or two fill characters or flags at the end. As you may have noted, see especially Dick Sherman's paper, short packets are *very* inefficient in any contention protocol. If a short time is reserved after every packet to allow the receiving party to start its acknowledgement, the acknowledgement packet does not suffer the inefficiencies of having to contend for the channel. The receiving station may need a while to set up the content of the acknowledgement packet it has to send, so the transmitting station must "fill" to give the receiving station time to get ready to send the acknowledgement. (Thanks to Hyperchannel(R) for this idea.)

As Sherman and others have pointed out, channel efficiency is greatly improved when packet size is much greater than the (speed of light) propagation delay between the contending stations. He considers a delay of 1% of the packet duration to be a nice maximum. If we want to communicate over 150 km (0.5 ms delay), our packets should last at least 50 ms. That isn't a serious limit at 1200 bauds, where bytes take 6.6 ms each. One should realize that, on the UHF bands where we are authorized "19600" bauds, some inefficiency may have to be tolerated on short control packets. At HF, where world-wide coverage (at 300 bauds) may occur, path delays may be as large as 50 - 100 ms; a byte lasts 26 ms, so only large packets are really efficient at maximum range. But the error rate may be so great that all large packets have errors. Maybe packets aren't a good idea at HF.

My missionary zeal is about expended for today, but be prepared for another onslaught some other day. I'll be monitoring (148.) 21 now and then and hope to run into you again. Maybe I'll get a computer together and be able to try packets with you, but it would be something of a busman's holiday.

73,

Bob Carpenter, W3OTC
12708 Circle Drive
Rockville, MD 20850

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NINE-DIGIT ZIP CODES are in the works for the United States. *The message: if you're writing a mailing list program, leave enough room.* According to the Postal Service, the new codes will be assigned in February 1981. Use of the new codes will be phased in 50% in 1982, 75 in 1984, and 90% in 1986. The new four digits will be separated from the existing 5 by a hyphen, *so leave room for that too! Allocating 10 spaces for postal codes should be sufficient for both the new U.S. codes and those already in use by other countries.*

Deaf RTTY Phone-Patching

Robert E. Bruninga, WB4APR
907 Ninovan Rd
Vienna, VA 22180
703-281-2762

A very significant contribution to Amateur Radio and the AMRAD project with the deaf community is to marry our extensive use of RTTY with their universal use of TTY for communicating. This idea came from a conversation with Cora Caldwell about trying to run a RTTY conversation between an individual at Gallaudet College and one of her friends back in Gooding Idaho. Cora Cladwell and her husband are radio amateurs involved with the deaf community in Idaho who are interested in bringing together the worlds of RTTY and TTY.

This triggered my imagination and I can envision a frequency on HF where a net meets periodically of RTTY enthusiasts for the purpose of relaying deaf TTY traffic. The only addition needed at the radio amateurs station is a phone coupler of the type used by the deaf inserted in the loop. These couplers are readily available at about $175 and have a 60 milliamp receiving loop with power supply and a 20 mill loop for a keyboard. This should fit nicely in a well equiped HF RTTY shack.

This note is just a call for interest. I think that AMRAD would be able to accept the donation of a phone coupler if there were a few active HF RTTY buffs who would be interested in connecting it up and to be listed as a RTTY/TTY phone patch station.

Bill Pala has volunteered to be the point of contact for this project and will coordinate the formation of the net and the availability of phone couplers and radio stations to participate. Please contact him if you have a coupler to donate, or if you have an active HF RTTY station and are interested in participating. One member has already indicated the availability of a complete HF radio station for possible donation. Bill's address is:

Bill Pala, WB4NFB
5829 Parakeet Dr.
Burke, Va. 22015

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FOR SALE: TDK FM-2016A 2-meter FM. $235. Comtronix FM80 10-meter FM. $135. Tarbell tape interface. Ron Finger, W4VZR, 3017 Talking Rock Dr, Fairfax, VA 22031; 703-280-1394 (home), 703-533-8877 x6666 (work).

Z-80 Selectric Conversion Program (SELCON)

Ronald J Finger, W4VZR
3017 Talking Rock Dr
Fairfax, VA 22031

SELCON is a program to convert ASCII characters to equivalent correspondence code which is used on IBM Selectric typewriters. The following code is for TDL/Xitan/CDL Z-80 assembler. Substitute "EQU" for == and "DB" for .BYTE for MAC. The character is assumed to be in register C.

```
SSTAT   ==      SELECTRIC STATUS PORT
SWORD   ==      OUTPUT STATUS WORD
SDATA   ==      SELECTRIC OUTPUT PORT
;The UART is programed for 6 data bits, odd parity
;
SLIST:  RES     7,C     ;REMOVE PARITY
        MOV     A,C     ;LOAD CHAR
        CPI     LF      ;LINE FEED?
        JRNZ    ..CKCR  ;NO
        LXI     H,CFLG  ;POINT TO CR FLAG
        BIT     0,M     ;CR FLAG HIGH?
        JRZ     ..IDX   ;NO, INDEX(LF)
        RES     0,M     ;YES, RESET & IGNORE LF
        RET             ;FOLLOWING A CR
..IDX:  MVI     B,56Q   ;SELECTRIC INDEX
        CALL    SELOP   ;OUTPUT
        MVI     B,12.   ;1 CHAR TIME DELAY
        JMPR    DELAY   ;DELAY & RETURN
..CKCR: CPI     CR      ;CR?
        JRZ     ..CROP  ;YES
        CPI     " "     ;CHECK FOR CONT CHAR
        RC              ;NO CONT CHAR ALLOWED
        JMPR    ..PRC   ;GO PROCESS CHAR
..CROP: MVI     C,55Q   ;SELECTRIC CR (&LF)
        CALL    SELOP   ;OUTPUT
        LXI     H,CFLG  ;POINT TO CR FLAG
        SET     0,M     ;SET FLAG
        INX     H       ;POINT TO CHAR COUNT BYTE
        MVI     A,24.   ;MIN EQUIV OF 2 INCHES OF CHAR
        ADD     M       ;ADD CHAR COUNT
        MVI     M,0     ;ZERO CHAR COUNTER
        MOV     B,A     ;MOVE TO COUNTING REG
        JMPR    DELAY   ;DELAY AFTER CR & RETURN
..PRC:  PUSH    H       ;SAVE REGS
        PUSH    B
        MVI     B,0     ;ZERO MSB'S
        LXI     H,SELTAB-32.    ;SET TO LOOKUP TABLE (NO CONT CHAR)
        DAD     B       ;ADD ASCII CHAR
        MOV     C,M     ;GET MATCH CHAR
        BIT     7,C     ;SAME IN UPPER & LOWER CASE?
        JRZ     ..PRCM  ;NO, PROCESS SOME MORE
..PRNT: LXI     H,COUNT
        INR     M       ;BUMP CHAR (PERLINE) COUNT
        CALL    SELOP   ;PRINT CHAR
        POP     B
```

```
        POP     H       ;RESTORE REGS
        RET
..PRCM: LXI     H,SFLG  ;POINT TO SHIFT FLAG
        MOV     A,C     ;LOAD CHAR
        XRA     M
        MOV     M,C     ;SAVE CHAR AS NEXT SHIFT FLAG
        BIT     6,A     ;CHECK SHIFT STATUS
        JRZ     ..PRNT  ;CASE IS SAME, OK TO PRINT
        PUSH    B       ;SAVE CHAR IN C
        BIT     6,C     ;CHECK CASE BIT
        JRNZ    ..UCS   ;ITS UPPER CASE
        MVI     C,37Q   ;ITS LOWER CASE
        JMPR    ..OPF
..UCS:  MVI     C,34Q   ;UPPER CASE SHIFT CHAR
..OPF:  CALL    SELOP   ;SHIFT
        MVI     B,6.    ;SET UP 36 MS DELAY
        CALL    DELAY
        POP     B
        JMPR    ..PRNT  ;NOW PRINT THE CHAR IN PROPER CASE
SELOP:  IN      SSTAT
        ANI     SWORD   ;MASK FOR TBE
        JRZ     SELOP   ;LOOP TILL READY
        MOV     A,C
        ANI     00111111B       ;MASK 6 BITS
        OUT     SDATA   ;OUTPUT CHAR TO SELECTRIC
        RET
DELAY:  XRA     A       ;6 ms. DELAY PER COUNT IN B (AT 2MHz)
        MOV     C,A
..DL:   XTHL            ;KILL TIME
        XTHL
        DCX     B
        CMP     B       ;DONE?
        JRNZ    ..DL    ;NO
        RET             ;YES
;
.RADIX 8        ;OCTAL RADIX FOR SELECTRIC LOOKUP TABLE
                ;CORRESPONDENCE CODE CONVERSION
                ;lower case char = 0XX
                ;upper case char = 1XX
                ;lower/upper case char such as period = 2XX
;
                ;(SPECIAL LOWER CASE CONVERSIONS)
                ;left brace (7BH)=BACKSPACE
                ;right brace (7DH)=TAB
                ;vertical slash (7CH)=CENTS
                ;alt mode (7EH)=DEGREES
;
SELTAB: .BYTE   200,1,111,160,104,110,150,11,164,144,170
        .BYTE   123,273,67,221,7,44,6,20,60,4,10,30,50
        .BYTE   70,64,153,53,200,23,200,107,120,171,166
        .BYTE   172,152,112,163,143,146,131,103,132,106
        .BYTE   141,122,105,113,133,151,145,102,162,161
        .BYTE   165,142,147,124,140,7,40,1,167,11
        .BYTE   71,66,72,52,12,63,43,46,31,3,32,6,41,22
        .BYTE   5,13,33,51,45,2,62,61,65,42,47,24,235
        .BYTE   130,257,101,275
;
.END
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ATARI COMPUTER PROGRAM EXCHANGE is a new club dedicated strictly to the Atari computers. As a member of this group you can swap programs and receive a monthly newsletter. Write: Atari Computer Program Exchange, 2022 79th St, Brooklyn, NY 11214. Dues are $15/year.

RCA SOLID STATE DIVISION has introduced the CDP1855 and the CDP1855C 8-bit multiply/divide units designed to be compatible with CDP1800-series microprocessor systems and to interface with most 8-bit microprocessors, increasing their capabilities. The two MDU's perform multiply and divide operations on unsigned, binary operators. These units feature 8-bit by 8-bit multiply or 16÷8-bit divide in 5 microseconds at 5 volts. These units are structured to permit cascading identical units to handle operands up to 32 bits. Each unit can do a 16N-bit by 8N-bit divide yielding an 8-bit result plus an 8N-bit remainder. The multiply is an 8N-bit by 8N-bit operation with a 16N-bit result. The "N" represents the number of cascaded CDP1855's and can be 1, 2, 3 or 4. The multiply/divide is based on the method of multiplying by add and shift right operations and dividing by subtract and shift left operations. Prices for 100-unit quantities available from stock are: CDP1855CD, $48.31; CDP1855D, $72.46. Copies of data sheet File No. 1053 may be obtained from RCA Solid State Division, Box 3200, Somerville, NJ 08876.

"MICROCOMPUTER INTERFACING," by Bruce Artwick is a new book on how to select, mate and match, build and interface to any application. It was published in January 1980 by Prentice-Hall, Inc, Englewood Cliffs, NJ 07632. 352 pages, 117 illustrations, 7 x 9.25.

CREATIVE COMPUTING, PO Box 789-M, Morristown NJ 07960, announces two programs for the APPLE II, Space War and Super Invasion. Both are on one disc (CS-4508) for a 48K APPLE II for $29.95. They are also offering the original computer version of Adventure on 8-inch CP/M disc for $24.95; a TRS-80 version on 5-inch disc is due in May 1980.

KNOWLEDGE INDUSTRY PUBLICATIONS, INC., 2 Corporate Park Dr, White Plains, NY 10604, has a number of new publications on video subjects. They include titles such as "The Video Register - Who's Who in Video?," "Videotext: The Coming Revolution in Home/Office Information Retrieval," and "Video in the Classroom".

COMPUTER NETWORK PROTOCOLS, Trends and Applications: 1980 will be held on May 29 at the National Bureau of Standards, Gaithersburg, MD, from 8:30 a.m. to 4:30 p.m. Early registration prior to May 15 is $20 for IEEE/NBS member, $25 non-member, $5 full-time student. Late registration is $25 for IEEE/NBS member, $30 non-member. Pay to TRENDS AND APPLICATIONS & mail to PO Box 639, Silver Spring, MD 20901. Those unable to attend but wishing proceedings can purchase them at $10.50 member, $14.00 non-member.

INTRODUCTION TO ADA COMPUTER PROGRAMMING LANGUAGE is a short course being offered by George Washington University Continuing Engineering on July 21-25. Telephone 202-676-6106. GW is also offering many other short courses of interest to computer and communications professionals. Write: The George Washington University School of Engineering and Applied Science, Washington, DC 20052 and ask for "Continuing Engineering Education CALENDAR."

HOWARD W. SAMS & CO, INC., 4300 West 62nd St, Indianapolis, IN 46268 announces some new books of interest to our members: "Guide to CMOS Basics, Circuits & Experiments," "TRS-80 Interfacing," and others. Most are available in area electronics stores.

SUN-FLEX COMPANY, 3020 Kerner Blvd, San Rafael, CA 94901 is selling optical filters for CRT's. Models are: 9-inch for the PET, $16.95; 12-inch for the TRS-80, $22.50; and, 15-inch CRT's $25.00. It is a black nylon mesh device, held under tension by a pastic frame. The overall effect is one of enhanced contrast, sharp resolution, no glare, and very minimal reflections per the company.

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THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of over 250 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD NEWSLETTER*. Except for the annual meeting in December, meetings are normally reserved for technical talks on computer or radio subjects.

THE WD4IWG/R REPEATER is an open repeater for data communications, voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent area coverage. It features a semi-private autopatch available to members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The repeater trustee and head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is a monthly publication which is mailed to all AMRAD members, editors of club newsletters which reciprocate and others. Technical articles, new product announcements, product evaluations, news items, calls for papers and other copy related to amateur radio and computers are welcome. Classified ads are free to members. Commercial advertisement inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. All items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the *AMRAD NEWSLETTER* is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Inquire for overseas rates.

THE AMRAD MESSAGE SYSTEM is an AMI 6800 computer bulletin board system accessible by telephone on 703-281-2125. It is compatible with originate modems in the Bell 103/113 series used in many terminals and personal computers. It automatically adjusts to either 110 or 300 baud speed upon receipt of several RETURNs when you sign on. From there it is self teaching. A sister system, VIRGINIA TTY, may be used by those with deaf TTYs by calling 703-281-1214. A handicapped educational exchange (HEX) is also operated by AMRAD. For details on any of these systems, please contact Bob Bruninga, WB4APR, 907 Ninovan Rd, Vienna, VA 22180; call him on the repeater or phone 703-281-2762.

AMRAD OFFICERS for 1980 are:

Gerald Adkins, N4GA	Treasurer
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THE AMRAD LIBRARY is operated by Bob Bruninga, WB4APR. It is an extensive collection of amateur radio and computer magazines, books and catalogs. Donations to the library are tax-deductible -- check with the Libraian for details.

AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio (FAR), the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC). AMRAD publishes a monthly column in the FAR magazine, *Auto-Call*.

TRAINING CLASSES on amateur radio and computing are run as needed by the membership. Please discuss your training requirements with any Director.

SPECIAL INTEREST GROUPS may be formed from time to time. If you are interested in joinging or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015, phone 703-323-8345.

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